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ABSTRACT

Of particular concern to educational psychologists when assessing hearing-impaired children is the identification of learning difficulties in addition to deafness which might hinder progress with language development. This study sought to replicate research which showed that some deaf children who have difficulty with fine motor movements and body image also have difficulty with speech musculature and thus with language learning by purely oral methods, and research which showed that relatively large percentages of deaf children exhibit dyspraxic features. A battery of diagnostic tests was administered to 106 British school-aged hearing-impaired children to detect dyspraxia. Only a small number of children were identified, and the main profiles emerging on 12 dyspraxia subtests differed from the profiles of former research subjects. The link between fine motor, speech, and certain memory tests was not replicated. The eupraxic/dyspraxic profile did not emerge for the subjects. (Author/JDD)

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IDENTIFICATION OF ADDITIONAL LEARNING DIFFICULTIES IN HEARING-IMPAIRED CHILDREN

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Abstract

Of particular concern to educational psychologists when assessing hearing-impaired children is the identification of learning difficulties in addition to deafness which might hinder progress with language development. Important decisions on educational placement and teaching methods are often made on the basis of particular test profiles. Some of the dangers inherent in this approach will be highlighted by examining the findings of a study which has investigated the profile of dyspraxia as described in the work of Van Uden (1981, 1983, for example). Van Uden suggests that some deaf children who have difficulty with fine motor movements and body image will also have difficulty with speech musculature and thus with language learning by purely oral methods. He reports relatively large percentages of deaf children with dyspraxic features, which he argues can be identified early by means of profile analysis on certain psychological tests.

Research recently undertaken in the Department of Audiology, Education of the Deaf and Speech Pathology at Manchester University with a population of school-aged hearing-impaired children, using a battery of diagnostic subtests to detect dyspraxia, identified only a small number of children with the profile. This paper will summarize the results of the analyses of the Van Uden and Manchester data, outlining the major linguistic/non-linguistic profile which emerged for the Manchester children. Individual characteristics of some of the children identified by profile analysis will be reported. These will include details of their cognitive and educational performance together with social and behavioral features.

A preliminary report of the work was presented at the Sixteenth International Congress on Education of the Deaf (Aplin, 1988). Discussion about the statistical techniques used for profile analysis can be found in Aplin (1987a). The social and emotional adjustment of children in the research has been described in Aplin (1987b).

The study raises a number of issues which are important in the psychological assessment of hearing-impaired children. These include criticisms of particular tests of cognitive ability, the

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possible dangers of early identification of learning difficulties by means of profile analysis where this leads to a self-fulfilling prophecy, whether a unitary disorder can account for language-learning problems in groups as heterogeneous as the hearing impaired and the features which might be associated with poor educational and linguistic attainment.

Introduction

Of particular concern to the educational psychologist when assessing hearing-impaired children is the identification of learning difficulties in addition to deafness which might hinder progress with language development. Van Uden's suggestion (see, for example, Van Uden, 1981, 1983) that some deaf children also have dyspraxia is of interest in this context. His concept of dyspraxia differs somewhat from that outlined in the literature on "clumsy" children and involves a number of features which constitute a syndrome. He describes it as a motor handicap which affects fine-finger movements, the development of rhythm, and movements of the speech musculature, so that those who are clumsy with their fingers are also clumsy in their speaking. In addition, he has noted that these dyspraxic children have a strong memory for simultaneously presented visual data (as opposed to memory for successively presented visual data). Eupraxic children (those showing fluent fine-motor and speech movements) have strengths in those areas which the dyspraxics find difficult.

Van Uden reports the results of a factor-analytic study which identified a eupraxia/dyspraxia main factor for 83 children aged seven to ten years. Fifteen subtests were used in the test battery. The children all had mean hearing losses in excess of 90 dBHL, a Performance IQ of 90 or above, and were being educated by oral methods. They were all attending the primary school department for the 'normal deaf' at Holland's Sint Michielsgestel and had no major additional handicaps which would have necessitated placement in a special class. The analysis showed that tests relating to the fine-motor functions of fingers and mouth (imitation of and memory of finger movements, paper folding, speech rhythms, and words)

showed clustered results, with positive loadings on the first, main factor. Negative loadings on this factor were found for tests of memory for simultaneously presented visual information (pictures, designs, symbols, and colors), indicating that those who were less fluent on motor tests performed better on such memory tests and vice versa. The importance of the factor increased with age.

Van Uden also reports that a relatively high percentage (in excess of 30%) of deaf children show some dyspraxic features. The children concerned in his research have all attended one particular school for the deaf and are not a total population of hearing-impaired children. They may therefore be a highly selected sample. The more severe cases are classified as severely dysphasic and are taught one-handed fingerspelling in addition to speech to assist their development of communication. The suggestion throughout Van Uden's work is that dyspraxic children can be identified early in their school life by means of his test battery. He states that decisions about the need for the additional special educational treatment may be taken in some cases at the school in Holland when a child is around the age of five-and-a-half years. Educational psychologists in Britain are also involved in making decisions about the appropriate kind of educational placement for young hearing-impaired children. In addition, they not infrequently see hearing-impaired children failing to make the expected linguistic progress who are referred at the ages of eight, nine, or even older for investigation of specific language-learning difficulties such as dyspraxia. The idea of identification and early remediation of such learning difficulties in hearing-impaired children is clearly of great interest to psychologists, teachers of the deaf, and others who work with the deaf. There are also, however, possible dangers inherent in such an approach since it could lead to an educational self-fulfilling prophecy.

Van Uden's work has been influential world-wide through both papers read at conferences and the courses which he has given for educationalists. Although it has been familiar to teachers of the deaf in Britain since the early 1970s, no research has been carried out so far in this country to assess whether the profile of dyspraxia can be found in a group of hearing-impaired children here. Indeed, there is no supporting evidence for his findings reported by any other researchers. Do the tests specified by Van Uden cluster together for another, different sample of hearing-impaired children? The relationship between fine-motor movements, speech, and memory, proposed by Van Uden, is disputable. Studies which have linked apraxia of speech with gross- or fine-motor disabilities in hearing children have not always been confirmed in subsequent research (see, for example, Williams et al., 1981). It seemed therefore that a study was required to investigate the psychometric test profile of dyspraxia in hearing-impaired children. As a member of a team working from the Department of Audiology and Education of the Deaf at Manchester University under the direction of Professor Taylor, the present author was in a unique position to carry out this research.

A preliminary report of the work was presented at the Sixteenth International Congress on Education of the Deaf (Aplin, 1988). Discussion about the statistical techniques used for profile analysis can be found in Aplin (1987a). The social and emotional adjustment of children in the research has been described in Aplin (1987b).

Subjects

In order to avoid biases in the selection of the children to be studied, a representative sample of hearing-impaired children such as a named population, rather than children who attended one school, was chosen. One hundred and six school-aged children with sensorineural hearing loss born in the city of Manchester during a ten-year period were the subjects of this

study. They were being educated in special schools for the hearing impaired (N=63) or language disordered (N=3), in units for the hearing impaired (N=5), or in ordinary schools with support from a peripatetic service for the hearing impaired (N=35) at the time of the study. There were 54 girls and 52 boys in the sample. Their ages ranged from seven to sixteen years, with a mean (x) of 12.4 years (s.d. 2.50). Their mean hearing losses in the better ear, averaged over the five frequencies 250 Hz, 500Hz, 1kHz, 2kHz, and 4kHz, ranged from 23 dB to 120dB (x 66.6dBHL, s.d. 27.08). Their WISC-R Performance IQs ranged from 45 to 146 (x 90.1, s.d. 16.36). Within the total sample there was a subgroup of 30 children with a mean hearing loss in the better ear of 90dBHL or more.

Scores reported in Van Uden (1983) for his group of 83 children were used for comparison with those of the Manchester sample. His children were aged seven (N=20), eight (N=18), nine (N=23), and ten (N=22) years. All had mean hearing losses greater than 90dB (x 108.5, s.d. 10.3) and WISC Performance IQs of 90 or more (x 107.1, s.d. 11.2).

Tests Administered

All children were assessed individually while wearing their personal hearing aids.

Only 12 of Van Uden's 15 suggested subtests (specified in Van Uden, 1983) were used in the present study. The tests used were:

1. WISC-R (Wechsler, 1974) Digit Span (DS)--an auditory memory test for digits in forward and reverse order. This test is from the WISC-R Verbal Scale.

2. WISC-R Coding (C)--a paper and pencil digit-symbol test from the Performance Scale of the WISC-R.

3. Hiskey-Nebraska (Hiskey, 1966) Memory for Color (MC)--up to six colors have to be remembered. This test is a visual memory test where possibly the use of an internal verbal coding strategy will help.

4. Hiskey-Nebraska Paper Folding (PF)--a visual memory test, where sequences of paper folds have to be remembered. This test assesses memory of successively presented information.

5. Hiskey-Nebraska Visual Attention Span (VAS)--memory for pictures: up to a sequence of seven pictures are presented simultaneously.

6. Successive Pictures (SP)--VAS in a successive presentation, i.e., one at a time instead of all in a row.

7. Bergès and Lezine Imitation of Gestures (BL)--imitation of 16 hand and finger movements.

8. Imitation of Finger Movements (IFM)--Van Uden's memory for finger-touching sequences.

9. Knox Cube Test (KC)--a test of memory for tapped sequences on four blocks. Up to a sequence of six taps can be given. This test also assesses memory of successively presented information.

10. Rhythm Test (RT)--a test of memory for spoken "ba ba" rhythms, e.g., " ba baba" and "baba ba ba." This test is auditory with a linguistic basis.

11. Benton Visual Retention Test (B)--a test of memory of designs shown for ten seconds then to be drawn on paper by the child.

12. Number of Words (NW)--this test of how many words the child can say in two minutes is clearly a language test.

Analyses

Initial R-technique factor analyses of results from the twelve subtests showed that different factors emerged for the Van Uden and Manchester samples. Q-technique and cluster analyses were also carried out (see Aplin, 1987a).

Only the results of some of the Q-technique factor analyses will be reported here. Q-technique of factor analysis groups together children (or cases) who show similar scores on certain tests, rather than grouping tests together as in the standard R-technique of factor analysis. Raw test scores are converted to standard scores (in this case T scores with a mean of 50 and a standard deviation of 10); the data matrix is then transposed and the factor loadings of the children define the subgroups. Profiles of the particular children isolated in this way can

then be investigated for the tests administered and a mean profile for this subgroup can be calculated. Q analyses were carried out by the PA 2 program (principal factoring with iteration), followed by varimax rotation from the Statistical Package for the Social Sciences (Nie et al., 1975). A four-factor solution was derived for the analysis, although only the first factor is presented here. Only those children with a factor loading of .60 or greater were used to arrive at the profiles discussed in this paper.

Re-analyzing Van Uden's own data on the 12 subtests by means of Q analysis revealed the negative and positive profiles depicted in Figure 1[2]. The graph shows the mean score profiles for the children with negative and positive loadings. From the total group (N=83), thirteen children showed a negative profile. As predicted from Van Uden's theory, these children showed a 'dyspraxic' profile with the lowest scores on tests of fine-finger movements, rhythm, speaking, and successive memory (Digit Span, Paper Folding, Bergès and Lezine, Imitation of Finger Movements, Knox Cube, Rhythm Test, and, to a lesser extent, Number of Words). Their strengths were on the simultaneous memory tests: Memory for Color, Visual Attention Span, Benton, and Coding (the latter is not a test of memory but of simultaneously presented information). The children with the positive loadings showed the reverse 'eupraxic' profile. Factor 1 extracted just over half of the total variance. Very similar profiles were found in the first factor in each separate age group of Van Uden's sample, when these were analyzed separately.

In order to see if Van Uden's main profiles could be found in the Manchester sample, his mean score profiles for dyspraxia and eupraxia for each of the four age groups were analyzed as 'dummy' cases together with the scores from the Manchester sample separated into three age

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[2] Figures and Tables are placed at the end of the article before references.

groups (seven to ten years, N=36; 11 to 13 years, N=33; and 14 to 16 years, N=37). With the negative version of the profile, the Van Uden study had isolated 13 of the 83 children (15.7%). Only five of the 106 Manchester children showed this profile (4.7%)--a very low percentage. Three Manchester children showed his positive, eupraxic profile.

Q analyses carried out on the scores of the Manchester sample alone revealed different mean score profiles compared with those of Van Uden's sample. The Factor 1 profiles extracted for the Manchester sample are depicted in Figure 2. Due to limitations of the factor program, only 100 children could be used in this analysis (six of the oldest children were discarded). The first factor extracted 36.5% of the total variance and revealed negative and positive profiles with nine children in each. The negative profile shows low mean scores on Digit Span, Memory for Color, Rhythm Test, and Number of Words. These four tests have consistently clustered together in the Manchester analyses and seem to represent the most highly verbal or verbally-biased tests within this battery, suggesting a 'linguistic ability' factor. The highest mean scores for the children with the negative profile are on the Paper folding, Bergés and Lezine, Imitation of Finger-Movements, and Benton tests, which could be considered as the most 'non-verbal' in the battery. The positive profile shows the reverse of these scores. Q analysis of the scores of the 30 children with mean hearing losses of 90dBHL or greater revealed similar mean score profiles and <u>not</u> the eupraxic/dyspraxic profile of the Van Uden sample.

Discussion

The Van Uden data consistently yielded one particular profile which emerged in the first factor of the Q factor analyses. It was a strong profile which in its positive and negative forms accounted for over half of the variance in the total group. It is consistent with Van Uden's

description of dyspraxia (and eupraxia) in deaf children. When the Van Uden profiles were incorporated into the Manchester data, only five children emerged with the negative profile, all of whom were children attending special schools. If the criteria specified by Van Uden are adhered to--that is, including children with a WISC-R Performance IQ of 90 or above and a hearing loss of more than 90dBHL--only two of the five children fit the pattern (1.9% of the total sample, or 6.67% of the 30 children with 90+ dBHL losses). One of these subjects did indeed have serious problems in developing oral linguistic skills. Her understanding and use of language was extremely limited at approximately a two-year level (chronological age 8 years 0 months). She was the youngest child of the five and the only one unable to gain a WISC-R Verbal Scale IQ. She had some fine- and gross-motor coordination difficulties for which she received physiotherapy, and she was profoundly deaf (mean hearing loss 97dBHL). Middle ear problems which had prevented the use of hearing aids at times and an absence from school for a period of some months could have contributed markedly to her poor linguistic progress. As her Performance IQ was below normal limits (68), however, she did not fulfill Van Uden's criterion for non-verbal intelligence. The only child of the five who fulfilled all of Van Uden's criteria for age (between seven and ten years), Performance IQ, and hearing loss was a boy of 10 years 11 months, with a Performance IQ of 129 and mean hearing loss of 96dBHL. This boy had been deafened through the rubella virus in contrast to the other four children whose deafness was of unknown etiology. He was a restless, fidgety boy; he had particular areas of weakness on four tests from the dyspraxia battery (Knox Cube, Imitation of Finger Movements, Digit Span, and Rhythm Test). However, he gained a Verbal IQ of 73 on the WISC-R and was not thought to have additional language-learning problems by his teachers. Subsequent to the research he left Special School to attend a mainstream school with a resource base for

hearing-impaired children where he has remained up to the present time. The question of the self-fulfilling prophecy is relevant to this case. If this boy had been selected by means of a test battery as having possible dyspraxic difficulties earlier in his life and if this selection had led to his being educated out of the normal oral system, would he have progressed so well? We can only speculate on the answer.

The three Manchester children who showed Van Uden's positive, eupraxic profile ranged in age from 8 years 8 months to 15 years 2 months, with mean hearing losses ranging from 27 to 83 dBHL and WISC-R Performance IQs from 88 to 95. None of the three fulfilled Van Uden's major criteria. All were girls for whom the etiology of hearing loss was unknown. One attended a special school, one was in mainstream schooling, and the third was in a unit for hearing-impaired children attached to a mainstream school. They all gained a WISC-R Verbal IQ (range from 74 to 88). They were not, however, children showing the greatest linguistic progress in the study, although two had only mild or moderate hearing losses (27 and 43dBHL). Although Van Uden suggests that 'eupraxic' children have facility with oral language, this suggestion was not borne out in the present study. Many other children in the Manchester sample, including some with severe to profound hearing losses, had greater linguistic achievements. (Criterion measures of linguistic ability in the study included an Estimated Expressive Language Age based on scores from some WISC-R Verbal subtests or the Reynell Developmental Language Scales-Revised [Reynell, 1977] and EPVT score [from the English Picture Vocabulary Test, Brimer and Dunn, 1973] giving a measure of vocabulary comprehension.) It is concluded, therefore, that even when children show the association between fluent fine-motor function, speech, and memory, they do not necessarily show a correspondingly high level of oral language ability.

The children identified from the Manchester sample by profiles shown in Figure 2 will now be discussed. The differences between the nine Manchester children with negative loadings on Factor 1 of the main Q analysis and the nine with positive loadings were investigated in some detail, and the results will be summarized here. As a group they were not significantly different in age or Performance IQ, although those with the positive profile had a significantly lower mean hearing loss. In addition to significantly higher mean scores on the dyspraxia tests--Digit Span, Memory for Color, Rhythm Test, and Number of Words--children with the positive profile also had significantly higher mean scores on language and reading measures used in the study (Burt, Schonell, EPVT, Estimated Expressive Language Age, and Best Reading Age) and two other Hiskey-Nebraska tests (Bead Patterns and Memory for Digits), thus emphasizing their linguistic capability and possibly greater use of an internal verbal coding strategy when compared with the children showing the negative profile. The latter children had a significantly higher mean score on the Bergès and Lezine test, a finding which is at variance with Van Uden's theory that this test is associated with linguistic ability.

The nine children with negative loadings on the main Manchester profile were a group of the more profoundly deaf children, with seven children having hearing losses equal to or greater than 90dBHL. Their mean hearing losses ranged from 70 to 116dBHL, with a mean of 94.11dBHL (s.d. 11.99dBHL). Table 1 summarizes some of the main details of the group. The age of diagnosis of hearing loss ranged form 10 months 11 years (this latter for a girl, No. 70, who attended a school for language-disordered children). The majority had, however, had their hearing loss diagnosed before the age of two years. In spite of this fact, only two children were able to gain a WISC-R Verbal IQ. Performance IQs ranged from 77 to 115 with a mean of 96 (s.d. 12.79). The best reading ages (RA) of the nine children ranged from 6 years 1 month to

11 years, and their EPVT ages from 2 years to only 6 years 3 months. All nine children attended Special Schools. For four children the cause of hearing loss was genetic, three were of unknown etiology, one was deafened by meningitis, and one by rubella.

What particular background features might have contributed to the slow development of linguistic skills for these children? Three of them (Nos. 40, 41, and 49) were from homes where English was spoken as a second language. Two of these were brothers, and so adverse features probably affected both children. In addition to the language problems, there were other home difficulties and the likelihood that hearing aids were not worn in the family setting. Both boys were only able to retain sequences of three digits after auditory presentation. The younger boy was making slightly more progress with oral language than his brother, perhaps due in part to the early diagnosis (11 months). He gained an Expressive age of 3 years 3 months on the Reynell Scales while his brother scored at the 2 years 11 months level. One girl from a Chinese-speaking family (No. 49) had early illness and surgery (suspected convulsions at 6 months and cleft palate repair at 10 months). She was also a quiet, withdrawn child who did not attempt to initiate conversations. In addition to the brothers referred to above, two other children (No. 43 and 47) had siblings who were profoundly deaf. This fact may have affected the quality and quantity of spoken language in the home. In addition, the hearing loss of child No. 43 was not diagnosed until the age of three years. Child No. 45, deafened by maternal rubella virus, was in poor physical condition in early life. In addition to deafness she had visual and heart defects associated with the rubella virus. Her early home life was socially deprived, and she was eventually adopted by her foster mother. Early behavior problems were reported. There was another adopted girl in the group (child No. 3). She was adopted early (at three months) with her twin into a very supportive home. Her hearing loss was diagnosed early (ten

months), although her hearing deteriorated before she went into school. She was the deafest child in this group and was progressing relatively well with a Verbal IQ of 68, just below the normal range, and a reading age of 9 years 4 months. Further progress was likely as she was only 12 years 7 months and being considered for integration into an ordinary school with maximum support. Two children (Nos. 69 and 70) had been misdiagnosed as language-disordered. They had not had consistent appropriate amplification or support from a teacher of the deaf. Although the girl was able to gain a Verbal IQ of 93, the boy's linguistic skills were very limited. On assessment they both presented as hearing-impaired children without amplification who were trying to understand and speak. Nothing in their behavior suggested that they were like any language-disordered children whom the present author has assessed. The two children (Nos. 3 and 70) with Verbal IQ scores had the lowest negative loadings. This finding lends some support to the interpretation that this factor represents some aspect of linguistic ability and suggests that these two children were the best achievers in this particular group of nine. The other seven children had scores on the Reynell Expressive Scale which ranged from 2 years 11 months (child No. 40) to 7 years (child No. 47). Four of the nine children (Nos. 40, 43, 45, and 3) were showing maladjusted behavior as assessed by their teachers on the Bristol Social Adjustment Guide (BSAG) (Stott, 1974) or Rutter Children's Behaviour Questionnaire (RCBQ) (Rutter, 1967) or on both measures. (Aplin [1985] found no significant relationship between maladjustment and hearing loss for the special school group as a whole.) As a group these nine children appeared to have greater language-learning difficulties than those selected as showing the 'dyspraxic' profile.

The nine children with positive loadings on the main Manchester profile had less severe mean hearing losses (range from 32 to 64dBHL, mean 43.22dBHL, s.d. 8.99dBHL). Table 2

summarizes some of the main details of the group. As might be expected for children with mild to moderate hearing losses, the age of diagnosis of hearing loss was generally much later than for the negative group and ranged from 2 years 6 months to 7 years 9 months. All the children were able to gain a Verbal IQ, and these ranged from 69 to 130 with a mean of 94.11 (s.d. 19.37). Indeed, for four children the Verbal IQ was higher than the Performance IQ. The Performance IQs showed a normal spread of scores, ranging from 72 to 121, with a mean of 97.44 (s.d. 17.74). The reading ages of the nine children ranged from 8 years to 15 years 8 months and their EPVT ages from 5 years 9 months to 18 years 1 month. The reading ages of six of these children were either in the average range or above. All except one child (No. 8 in a Special School for partially-hearing children) attended ordinary schools, usually with support or intermittent monitoring from their peripatetic service. For three children the cause of hearing loss was genetic, while for the other six the loss was of unknown etiology.

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Put Table ?? 4 about here

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Were there any particular features that might have contributed to good development of linguistic skills for these children? The lesser degree of their hearing loss was an advantage, although the generally late age of diagnosis of the loss could be a detrimental factor in linguistic progress. Only one of the children (No. 83) was from a home where English was spoken as a second language, in contrast to three children in the negative group. This child also had a hearing-impaired sister in the study. Another child (No. 75) had a sister and mother who were both moderately hearing impaired. One other child (No. 100) had a brother with a moderate hearing impairment. Two children (Nos. 83 and 75) were showing maladjusted behavior as assessed by their teachers on the BSAG and RCBQ.

As a group these nine children appeared to be showing greater language-learning ability than those selected as showing the 'eupraxic' profile. These nine children, who had a profile of high scores on Digit Span, Memory for Color, Rhythm Test, and Number of Words, as opposed to their lower scores on Bergès and Lezine and Imitation of Finger Movements, did not necessarily include all of those with the 'best' linguistic progress in the Manchester sample, but they were nevertheless showing satisfactory progress. High scores on these four tests would therefore seem to be indicative of general linguistic progress.

Conclusions

The main profiles emerging for the Van Uden and Manchester samples on the twelve dyspraxia subtests differed. The link between fine-motor, speech, and certain memory tests found for Van Uden's children was not replicated in the Manchester population of children with wider ranges of age and hearing loss. The eupraxic/dyspraxic profile did not emerge for the Manchester children even when those with mean hearing losses of 90dBHL or greater were investigated.

A small percentage of Manchester children showed the dyspraxic profile, but the one child who fulfilled all of Van Uden's specified criteria did not have additional language-learning difficulties. This finding suggests that there may be dangers in the early identification of children by means of a test battery for which the validity is uncertain. It also emphasizes the need to verify certain test profiles found for restricted samples of deaf children (such as those attending one particular school) on a wider population of hearing-impaired children. The heterogeneity of samples of hearing-impaired children is well-known and well-documented. It is perhaps unlikely that a unitary disorder could account for language-learning problems in large numbers of children as heterogeneous as the hearing impaired (with regard to factors such as etiology, age of diagnosis, use and effectiveness of amplification, specialist support, home and school environments, etc.).

The major profile which emerged for the Manchester sample suggests a verbal/non-verbal dichotomy within the twelve dyspraxia subtests. This profile seems to be meaningful for children with hearing impairment and suggests that a small number of the subtests in Van Uden's battery may be useful predictors of linguistic ability. Further investigations are being carried out at Manchester to combine these tests with other measures in order to establish a set of best predictors of linguistic progress in hearing-impaired children.

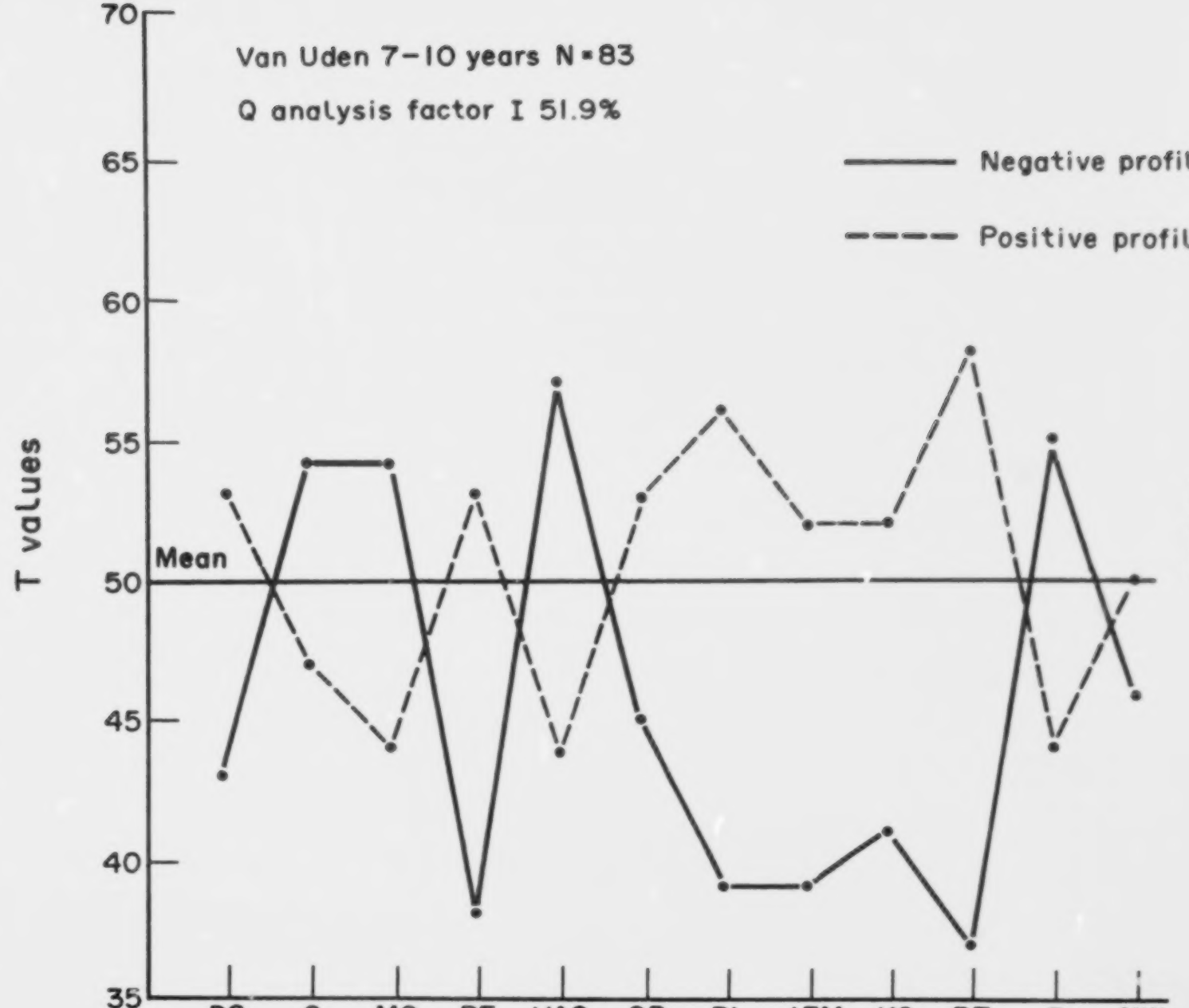
Van Uden 7–10 years N=83
Q analysis factor I 51.9%
Negative profile N=13
Positive profile N=18
T values
70
65
60
55
50
45
40
35
Mean
DS
C
MC
PF
VAS
SP
BL
IFM
KC
RT
B
NW

FIGURE 1

Manchester research N=100
Q analysis factor I 36.5%
Negative profile N=9
Positive profile N=9
T values
70
65
60
55
50
45
40
35
Mean
DS
C
MC
PF
VAS
SP
BL
IFM
KC
RT
B
NW

FIGURE 2

Table 1. Nine 'Negative' Manchester Children

CHILD NO.	SEX	C. A.	AET.	AGE of DIAG.	$\bar{X}$ LOSS DBHL	SCHOOL	P. IQ	V. IQ (or EXP. LANG. AGE)	BEST R. A.	EPVT AGE
40	M	11y 0m	Gen.	1y 6m	95	Spec.	90	(2y 11m)	7y 1m	2y 0m
69	M	14y 6m	Unk.	1y 7m	95	Spec.	109	(4y 0m)	9y 2m	5y 3m
43	M	11y 0m	Gen.	3y 0m	94	Spec.	115	(4y 5m)	7y 7m	4y 4m
45	F	9y 3m	Rub.	10m	94	Spec.	95	(4y 11m)	7y 7m	3y 1m
49	F	10y 5m	Unk.	2y 9m	100	Spec.	77	(3y 2m)	7y 5m	2y 0m
41	M	9y 2m	Gen.	11m	96	Spec.	78	(3y 3m)	6y 1m	2y 0m
47	F	14y 3m	Gen.	1y 11m	70	Spec.	100	(7y 0m)	9y 4m	5y 7m
3	F	12y 7m	Men.	10m	116	Spec.	102	68	9y 4m	5y 11m
70	F	14y 8m	Unk.	11y 0m	87	Spec.	98	73	11y 0m	6y 3m

Table 2. Nine 'Positive' Manchester Children

CHILD NO.	SEX	C. A.	AET.	AGE of DIAG.	$\bar{X}$ LOSS DBHL	SCHOOL	P. IQ	V. IQ (or EXP. LANG. AGE)	BEST R. A.	EPVT AGE
83	M	15y 7m	Gen.	7y 9m	43	Ord.	72	69	8y 6m	6y 0m
93	F	15y 2m	Unk.	6y 0m	64	Ord.	82	91	15y 4m	13y 3m
75	M	8y 0m	Gen.	2y 6m	43	Ord.	93	84	8y 0m	5y 9m
100	F	8y 11	Gen.	6y 2m	32	Ord.	98	91	7y 7m	3y 1m
96	F	14y 5m	Unk.	5y 0m	49	Ord.	106	98	11y 6m	7y 11m
78	M	12y 0m	Unk.	6y 0m	40	Ord.	117	118	15y 8m	12y 6m
85	M	10y 9m	Unk.	3y 6m	39	Ord.	121	130	15y 8m	18y 1m
106	F	9y 3m	Unk.	5y 0m	40	Ord.	111	101	8y 7m	6y 11m
8	M	15y 9m	Unk.	4y 2m	39	Spec.	77	85	14y 6m	9y 3m

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